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DISCUSSION PAPER SERIES

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DP# 9 **June 2008**

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Are leading papers of better quality? Evidence from a natural experiment[*]

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June 2008

Abstract

Leading papers in a journal's issue attract, on average, more citations than those that follow. It is, however, difficult to assess whether they are of better quality (as is often suggested), or whether this happens just because they appear first in an issue. We make use of a natural experiment that was carried out by a journal in which papers are randomly ordered in some issues, while this order is not random in others. We show that leading papers in randomly ordered issues also attract more citations, which casts some doubt on whether, in general, leading papers are of higher quality.

Introduction

Several papers (Scott and Waldfogel, 1996, Ayres and Vars, 2000, Hudson, 2007, Oswald, 2007) raise the possibility that the leading (that is first placed) article in an issue of a journal attracts more citations than those that appear later. Pinkowitz (2000) draws the same conclusion based on web site downloads of articles that are (pre) published on the website of the *Journal of Finance*. The hypothesis is tested by running a regression of the number of citations (or downloads) of an article on the order in which it is placed, and on some other variables, such as time since

[*] We are grateful to Orley Ashenfelter, John Hudson and Andrew Oswald for extremely useful comments on a preliminary version,

publication, journal, and subject area (Ayres and Vars, 2000), as well as number of authors, self-citations and whether it is the author's first paper (Hudson, 2007).[1]

Though this is not Oswald's (2007) main concern, he suggests that "the way in which [editors] arranged the order of publication, … turned out, *ex post*, to … what now looks like prior foresight" about which papers are good and which are less so. He also suggests that it seems worth exploring "what editors know, and exactly how they know it" when they make their decision on the ordering of papers.

However, it is difficult to assert that leading articles are of better quality and therefore attract more citations (which we take, but only *ex post*, as a quality signal). They may attract more citations just because they appear first in a journal's issue. The problem is that, in various contexts, such as artistic (Ginsburgh and Van Ours, 2003), sports (Lee, 2004) and even scientific (Coupé, 2007) competitions where evaluation is subjective, the order of appearance of subjects (Ginsburgh and Van Ours, 2003), or other factors such as an outlier aversion bias (Lee, 2004) affect the way judges perceive quality. If the order in which articles appear in academic journals plays a similar role it would make little sense to suspect a causal relation between leading article and quality, and citations.

This could be given a straightforward answer if an editor were ready to run an experiment which would consist in ordering papers in a random way in some issues, while in other issues, she would order them in some thoughtful way (using her gut feelings and experience). One could then test whether leading articles in randomly ordered issues also attract more citations than those that appear later, and whether the differences between the two orderings (random and "thoughtful") are statistically significantly different.[2]

European Economic Review (*EER*) provides such an "experiment." Between 1975 and 1997 some issues use the initial of the first author's surname to order papers (the issues in which the order is alphabetical are reported in Appendix Table A2), others do not. As long as one is ready to accept that the alphabetical order is random, in the sense that on average it cannot help sorting good and bad papers,[3] this can be considered as a natural experiment. If in "alphabetically ordered" issues, leading papers get more citations than others, then one can wonder whether editors really have a good guess at quality when they order in a thoughtful way.

[1] See also Oswald (2008) for a related paper that provides a way of testing whether journals discriminate across nationalities (essentially European vs American authors), and whether there is a pro-Harvard bias in the *Quarterly Journal of Economics*.

[2] This idea was exploited by Ayres and Vars (2000, pp. 444-445) using law reviews, but they pooled different journals, some of which were using the alphabetical order, some were not.

[3] Note that some papers (for example, Einav and Yariv, 2006) suggest that authors whose names appear early in the alphabet are more likely to receive tenure. There seems thus to be discrimination on the basis of the initial of the surname. There is also a small probability that alphabetical and quality orderings are identical. We ignore this possibility.

Leading papers are more cited because they are leading (and/or readers expect them to be better), and not because they are of better quality.

Before moving to our analysis, focused on the natural experiment in *EER*, we briefly describe the results obtained by Scott and Waldfogel (1996), Ayres and Vars (2000), Hudson, (2007) Oswald (2007) and Pinkowitz (2000). They all find that the order of a paper in an issue matters, and that better placed papers generate more citations. The number of pages has also a positive impact, whereas notes are much less cited. Hudson (2007) finds that self-citations generate more citations, since they provide additional signals with respect to the quality of the cited paper. He also points out that a highly cited paper has a positive impact on the citations of other papers in the same issue. According to Hudson, this highlights, "the role chance can play in determining citation impact."

Analysis

The analysis that follows will aim at comparing the number of citations conditional on ordering, which may be alphabetical or not in the case of *European Economic Review* (*EER*). To check for consistency, we will also compare this with citations to papers in *American Economic Review* (*AER*), where the order is never alphabetical (except by chance).[4] Special issues (such as *EER* and *AER Papers and Proceedings*, International Seminars on Macroeconomics or Microeconomics that *EER* was publishing once a year some years ago) as well as editorials that appear as first paper in some issues were not taken into account.[5]

Table 1 gives a first descriptive view of the average number of citations conditional on order. The results show that in all cases, the first paper in an issue gets more citations, but standard deviations are very large. In contrast, the difference in citations with the second ordered paper is not very large. Finally, citations per paper are rather constant after the fifth paper, though there may be sudden surges such as the tenth paper in *EER* (non-alphabetical ordering) and in *AER*, which both get a larger number of cites than the first ordered paper. [6]

[4] The order may have been random before 1985, at a time where the journal had a large backlog of papers, and some papers were published when ready for publication, and in that order. The fact that there was a large backlog at the time is mentioned in the editor's report in *American Economic Review, Papers and Proceedings* 73 (1983), p. 402, but nothing is mentioned about the way papers were ordered in the various issues. However, to make sure that we do not capture issues with randomly ordered papers, the results concerned with *AER* only take into account volumes that were published after 1985, a time at which a new editor was appointed.

[5] Editorials are ignored, and we consider the paper that follows as leading paper. Nobel lectures which appear as leading papers in *AER* have not been removed.

[6] See also Appendix Tables A1 for descriptive statistics concerning the dataset.

It is, however, important to condition on some other variables, including the length and the age of the paper, as well as distinguishing between notes and full-fledged papers. To this end, we set up the following model that will be estimated separately for *EER* and *AER*:

$$y_a = \sum_1^m \alpha_i O_{ia} + \beta L_a + \gamma N_a + \sum \delta_\tau Y_{\tau a} + u_a$$

where subscript *a* refers to a given article, *y* is the number of times this article is cited (the count is made in 2000[7]), the O_{ia} are dummy variables representing the order in which article *a* appears in an issue of the journal (O_{ia} is equal to 1 if the order in which paper *a* is published is *i, i* = 1, 2, …, *m*), *L* is its length (number of pages), *N* is a dummy equal to 1 if the article is a note or comment, the *Y* are annual dummies that capture the time at which the article was published, and *u* an error term; $\alpha, \beta, \gamma, \delta$ are parameters.

Both the order in which an article appears and the year in which it was published are represented by order or annual dummies to avoid assumptions on the functional form according to which a paper gains (or looses) citations according to its order, or when it gets older.[8] After some experimentation, and because the observed differences in citations counts remain roughly equal (and unrelated to order) after the fourth or fifth paper in an issue, we decided to report our results with *m* = 5 only. Since citations are count data, the equations are estimated using the Poisson regression model.

The results of three Poisson regressions (two for *EER*, one for *AER*) are displayed in Table 2. Since the rough results of count models (reproduced in column (1) of Appendix Tables A3, A4 and A6) are difficult to interpret, this table reports only the estimated marginal effects computed on the basis of the regression parameters.[9] The table also includes the mean number of citations. This is the mean predicted by the Poisson regression at the mean of each right-hand side variable.

Results show that first ordered papers get marginally more citations in all three versions of the model (*EER* alphabetically ordered, *EER* non-alphabetically ordered and *AER*). As expected, the mean for *AER* is much larger than for *EER* (23 v. 5), and though the marginal effects show that the first paper in an issue benefits from a larger (and significantly different from zero in all three cases) number of citations, the marginal effects between *AER* and *EER*

[7] Citations are counted in 2000, to papers published at the latest in 1997. There is thus at least a three-years lag between citations count and date of publication.

[8] We also ran regressions with time and time squared. This had very little influence on the "order" parameters that we are interested in here.

[9] See Cameron and Trivedi (2005, p. 669). For the parameters picked by dummy variables such as order, the marginal effect is computed as the effect of changing the value of the dummy from 0 to 1.

papers are not very large (5 v. 2 or 3). Moreover, for *EER* the difference in the marginal effect on citations of the first paper is not very different for alphabetical and non-alphabetical issues (1.8 v. 3.1), though a likelihood ratio test shows that the difference is statistically significantly different from zero. Thus, there are less citations to the first paper when the order is alphabetical, but the difference is not large. Moreover, the differences in marginal citations between the first and the second paper are almost identical (1.74 in the alphabetical order, 1.69 in the non-alphabetical order). Note that this difference is even smaller in the case of *AER* (1.00).[10]

Longer papers are more cited than short ones, and notes are usually less cited (for *AER* the difference is quite large). The sequence of annual dummies which represent the year of publication, and thus the age of the paper in 2000, pick coefficients that are declining in the case of *AER.* Thus, the more recent a paper, the less it is cited, which is expected. The coefficients show no particular trend for *EER*. One possible reason is that the natural decrease of citations for more recent papers is compensated by more citations due to increasing average quality over time.

We also examined the issue raised by Hudson (2007) who observes that a well-cited paper enhances citations to other papers in the same issue. To test for this, we ran a Poisson regression (that excludes first leading papers), pooling alphabetical and non-alphabetical observations for *EER*. The equation is similar to the first one and reads:

$$y_a = \phi D_a + \beta L_a + \gamma N_a + \sum \delta_\tau Y_{\tau a} + u_a$$

It ignores orderings but includes a dummy D_a that takes the value 1 for alphabetically ordered issues. The coefficient picked by this dummy should tell us whether the average numbers of citations differ between the two types of orderings. This marginal effect turns out to be equal to -0.38 with a standard error of 0.20. Thus, papers in alphabetically ordered issues attract less citations than those appearing in non-alphabetically ordered issues, but the difference is hardly significantly different from zero at the usual five percent probability level.[11]

As a robustness check, a series of additional regressions were carried out, which confirm the results described above. We changed *m* (the number of ordered papers), replaced annual dummies by some imposed functional form of time between publication and citations in 2000 (linear and quadratic), and varied the number of volumes of both journals included in the

[10] It also worth mentioning that between 1985 and 1997, all *AER* papers that appear in order 1 to 8 get citations and only 2 percent and 4 percent of the papers ordered 9th and10th respectively, are not cited This is far from being the case in EER, where some 15 percent of the papers never get cited, whatever their order.

[11] OLS estimation leads to a coefficient of -0.5, with a standard error of 1.05, confirming the result of the count model.

regressions.[12] We also ran some regressions in which we pool both alphabetical and non-alphabetical issues. Finally, OLS regressions results are similar to those obtained with the Poisson model. OLS can be justified for *AER*, since some papers get a large number of citations, and the independent variable can be considered continuous. But this approximation does not hold for *EER*, where most papers are not cited that often, and up to 15 percent get no citation at all.

Conclusions

Our main conclusion drawn from the natural experiment run by *European Economic Review* is that the number of citations does hardly depend on the supposed higher quality of the leading paper, picked by the editor of a journal. An ordering of papers by alphabetical order of the initial of the surname of the (first) author has roughly the same effect as a "thoughtful" quality ordering that the editor(s) assume when they chose the order. This may however be the consequence of several alternative factors that cannot be distinguished:
(a) The editors of *EER* gave poor quality signals, and readers cite more (or an equal number of times) papers that appear later in an issue;
(b) Readers of *EER* think that the first paper in an issue is qualitatively better than those that follow, even if it is not, because they are used to this being the case in *AER* for example, but also in many other economics journals.

Whether this result is *EER*-specific should be verified using other journals which ran such "natural experiments."

Do these observations lead to policy rules that should be followed by editors who maximize the citations given to papers in their journal? Clearly, good quality papers are important if citations is what counts, and has, according to Hudson (2007), positive externalities on other papers, thus enhancing even more the citations to a journal. This is however not observed in our case.

Ranks of journals and citations have become important to evaluate scientists, though as made clear by Oswald (2007) and Hudson (2007), there exist highly-cited papers in less reputable journals and citations may be due to chance.

It is less clear whether it is worth ordering papers in some order supposed to represent quality, since the number of additional citations given to leading papers is not much larger than those given to other papers. Obviously the cost to the editor of doing this is probably not very high, so why should he not do it? But it may be costly for young scientists, since well-established (and highly cited) scientists may win twice by getting even more citations than what they truly

[12] See Appendix Tables A3 to A6, which give the results of Poisson regressions for the results described in the paper as well as for alternative formulations.

deserve: first because they write good articles and second because their articles are placed as lead articles. This practice may result in intensifying the emergence of "superstars", help conservatism and even crowd out some good articles by younger scientists who do not get properly cited.

The appearance of new electronic journals, as well as the fact that old-time paper journals become electronic may induce changes in these patterns. Scientists are now becoming used to download individual papers, and have, in general, no access to the issues of a journal (though the journal still exists, even if virtually, and papers are ordered in each issue). But the fact that paper copies do not lie on the desk of a scientist will certainly have an influence in particular on the observation made by Hudson (but not confirmed for *EER*), that a well-cited paper enhances citations to other papers in the same issue.

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Table 1. Cites conditional on order in an issue

	EER alphabetical		EER non-alphabetical		AER	
	Mean	Stand. Dev.	Mean	Stand. Dev.	Mean	Stand. Dev.
First in issue	7.7	10.6	11.4	17.6	45.4	35.5
Second in issue	5.6	6.2	8.9	24.8	49.0	46.4
Third in issue	5.5	8.9	5.8	6.9	37.8	48.4
Fourth in issue	5.5	8.8	5.1	6.3	42.5	44.9
Fifth in issue	6.3	6.7	4.7	5.9	30.3	29.6
Sixth in issue	4.1	5.2	7.2	11.9	38.7	31.3
Seventh in issue	6.4	11.9	5.9	7.7	41.8	50.9
Eight in issue	5.8	11.2	5.4	6.7	33.7	37.9
Ninth in issue	4.0	4.6	3.6	5.3	26.2	22.0
Tenth in issue	11.5	22.5	3.7	4.5	51.1	72.6
No. of obs.	303		760		1198	

Table 2. Marginal effects in the Poisson regression

	EER alphabetical		EER non-alphabetical		AER	
	Marg. Effect	Stand. error	Marg. Effect	Stand. error	Marg. Effect	Stand. error
First in issue	1.88	0.47	3.12	0.33	5.19	0.44
Second in issues	0.14	0.42	1.43	0.30	4.20	0.43
Third in issue	-0.11	0.40	-0.49	0.26	-0.87	0.41
Fourth in issue	0.74	0.46	-1.05	0.25	1.92	0.38
Fifth in issue	0.90	0.47	-1.41	0.25	-2.33	0.44
No. of pages	0.26	0.02	0.20	0.01	1.32	0.02
Note	0.48	2.84	-3.74	0.36	-13.05	0.25
Annual dummies	yes		yes		yes	
Mean	5.12		5.49		23.44	
No. of obs.	303		760		1198	

Table A1 Descriptive Statistics

Variable	No. of obs.	Mean	Std deviation	Minimum	Maximum
EER					
Cites	1063	6.291	11.54	0	220
Alphabetical issues	1063	0.285	0.451	0	1
Order	1063	5.117	3.258	1	22
No. of pages	1063	17.689	7.156	2	53
Note	1063	0.022	0.148	0	1
First in issue	1063	0.121	0.326	0	1
Second in issue	1063	0.121	0.326	0	1
Third in issue	1063	0.121	0.326	0	1
Fourth in issue	1063	0.121	0.325	0	1
Fifth in issue	1063	0.111	0.314	0	1
AER					
Cites	1198	28.751	39.981	0	473
Order	1198	12.459	7.3754	1	36
No. of pages	1198	13.18	6.687	1	53
Note	1198	0.226	0.418	0	1
First in issue	1198	0.043	0.203	0	1
Second in issue	1198	0.043	0.203	0	1
Third in issue	1198	0.043	0.203	0	1
Fourth in issue	1198	0.043	0.203	0	1
Fifth in issue	1198	0.043	0.203	0	1

Table A2 *European Economic Review* issues with alphabetical ordering of articles

Year	Issue	Volume	No
1974	54	5	4
1975	61	6	1
1975	62	6	2
1976	73	7	3
1976	83	8	3
1980	132	13	2
1980	142	14	2
1980	143	14	3
1983	213	21	3
1983	222	22	2
1983	223	22	3
1983	231	23	1
1983	232	23	2
1983	233	23	3
1984	241	24	1
1984	242	24	2
1984	243	24	3
1984	252	25	2
1984	253	25	3
1984	261	26	1
1984	263	26	3
1985	291	29	1
1985	292	29	2
1985	293	29	9
1987	315	31	5
1987	316	31	6
1987	317	31	7
1987	318	31	8
1988	321	32	1
1989	338	33	8
1992	368	36	8
1995	392	39	2
1995	396	39	6
1995	397	39	7
1995	399	39	9
1996	406	40	6
1996	409	40	9
1997	416	41	6
1997	417	41	7
1997	419	41	9

Table A3 Alternative Results of Poisson Regressions, EER alphabetical

	(1)	(2)	(3)	(4)
First in issue	0.325	0.287		0.286
	(0.072)**	(0.071)**		(0.071)**
Second in issue	0.027	-0.018		-0.018
	(0.08)	(0.079)		(0.079)
Third in issue	-0.021	-0.07		-0.071
	(0.081)	(0.080)		(0.080)
Fourth in issue	0.138	0.06		0.059
	(0.082)	(0.080)		(0.080)
Fifth in issue	0.164	0.123		0.123
	(0.081)*	-0.081		-0.081
No. of pages	0.050	0.042	0.050	0.042
	(0.004)**	(0.003)**	(0.004)**	(0.003)**
Note	0.091	-0.037	0.22	-0.036
	(0.508)	(0.506)	(0.505)	(0.506)
Age		-0.014		-0.015
		(0.016)		(0.004)**
Age Squared		0.000		
		-0.001		
Order (linear)			-0.059	
			(0.024)*	
Order squared			0.004	
			(0.002)	
Intercept	-0.200	1.135	0.041	1.141
	(0.307)	(0.131)**	(0.306)	(0.095)**
Annual dummies	Yes	No	Yes	No
No. of obs.	303	303	303	303

Dependent variable: No. of cites

Standard errors between brackets: * and ** significantly different from 0 at 5 and 1% level

Table A4 Alternative Results of Poisson Regressions, EER non-alphabetical

	(1)	(2)	(3)	(4)
First in issue	0.471	0.441		0.428
	(0.042)**	(0.042)**		(0.042)**
Second in issue	0.237	0.25		-0.073
	(0.045)**	(0.044)**		-0.049
Third in issue	-0.092	-0.071		-0.073
	(0.051)	(0.051)		(0.051)
Fourth in issue	-0.208	-0.21		-0.214
	(0.054)**	(0.054)**		(0.053)**
Fifth in issue	-0.287	-0.273		-0.275
	(0.056)**	(0.056)**		(0.056)**
No. of pages	0.036	0.037	0.037	0.039
	(0.002)**	(0.002)**	(0.002)**	(0.002)**
Note	-1.082	-1.037	-0.869	-0.994
	(0.179)**	(0.177)**	(0.179)**	(0.177)**
Age		0.066		0.019
		(0.012)**		(0.002)**
Age squared		-0.001		
		(0.000)**		
Order (linear)			-0.109	
			(0.012)**	
Order squared			0.004	
			(0.001)**	
Intercept	1.631	0.529	1.978	0.828
	(0.097)**	(0.096)**	(0.101)**	(0.054)**
Annual dummies	Yes	No	Yes	No
No. of obs.	760	760	760	759

Dependent variable: No. of cites

Standard errors between brackets: * and ** significantly different from 0 at 5 and 1% level

Table A5 Alternative Results of Poisson Regressions, EER all issues

	(1)	(2)	(3)	(4)
First in issue	0.493	0.471		0.466
	(0.040)**	(0.039)**		(0.039)**
Second in issue	0.281	0.286		-0.029
	(0.043)**	(0.042)**		(0.047)
Third in issue	-0.036	-0.033		-0.028
	(0.049)	(0.049)		(0.049)
Fourth in issue	-0.170	-0.170		-0.165
	(0.052)**	(0.052)**		(0.052)**
Fifth in issue	-0.241	-0.240		-0.237
	(0.055)**	(0.055)**		(0.054)**
First in issue*Alpha	-0.302	-0.270		-0.263
	(0.069)**	(0.065)**		(0.065)**
Second in issue*Alpha	-0.414	-0.4		-0.081
	(0.078)**	(0.076)**		-0.079
Third in issue*Alpha	-0.156	-0.142		-0.142
	(0.083)	(0.081)		(0.081)
Fourth in issue*Alpha	0.108	0.119		0.121
	(0.085)	(0.083)		(0.083)
Fifth in issue*Alpha	0.291	0.301		0.302
	(0.088)**	(0.086)**		(0.086)**
No. of pages	0.039	0.038	0.041	0.04
	(0.002)**	(0.002)**	(0.002)**	(0.002)**
Note	-0.883	-0.903	-0.762	-0.869
	(0.168)**	(0.167)**	(0.169)**	(0.167)**
Age (linear)		0.023		0.01
		(0.009)*		(0.002)**
Age squared		0.000		
		(0.000)		
Order (linear)			-0.104	
			(0.011)**	
Order squared			0.005	
			(0.001)**	
Order*Alpha			0.001	
			(0.006)	
Intercept	0.236	0.827	0.359	0.903
	(0.294)	(0.076)**	(0.293)	(0.047)**
Year Dummies	Yes	No	Yes	No
No. of obs.	1063	1063	1063	1062

Dependent variable: No. of cites

Standard errors between brackets: * and ** significantly different from 0 at 5 and 1% level

Table A6 Alternative Results of Poisson Regressions, AER

	(1)	(2)	(3)	(4)
First in issue	0.202	0.189		0.189
	(0.022)**	(0.022)**		(0.022)**
Second in issue	0.166	0.158		0.155
	(0.021)**	(0.021)**		(0.021)**
Third in issue	-0.038	-0.052		-0.053
	(0.024)	(0.024)*		(0.024)*
Fourth in issue	0.079	0.07		0.068
	(0.023)**	(0.023)**		(0.023)**
Fifth in issue	-0.104	-0.112		-0.11
	(0.026)**	(0.026)**		(0.026)**
No. of pages	0.057	0.057	0.05	0.059
	(0.001)**	(0.001)**	(0.001)**	(0.001)**
Note	-0.654	-0.635	-0.339	-0.594
	(0.020)**	(0.020)**	(0.023)**	(0.020)**
Age (linear)		0.283	0.116	0.117
		(0.010)**	(0.002)**	(0.002)**
Age squared		-0.008		
		(0.000)**		
Order (linear)			0.024	
			(0.003)**	
Order squared			-0.002	
			(0.000)**	
Intercept	1.835	0.544	1.500	1.310
	(0.032)**	(0.055)**	(0.034)**	(0.026)**
Annual dummies	Yes	No	No	No
No. of obs.	1198	1198	1198	1198

Dependent variable: No. of cites

Standard errors between brackets: * and ** significantly different from 0 at 5 and 1% level